Space Weather Technical Forecast

Issued on Wednesday, 05 April 2023 at 13:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Active electron fluence likely. Slight chance of Minor Geomagnetic Storms on 05 Apr. Slight chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low with no significant flares. There are four sunspot regions on the visible disc, with three of these stable and benign. AR3270 is the most prominent region on the disc, in the southwest quadrant, which has contained a transient delta spot over the last 24 hours. A CME has been observed leaving the southeast of the Sun. Although it is unlikely to be Earth-directed from this location, analysis will be undertaken as further data becomes available.

Solar Wind / Geomagnetic Activity: The solar wind as observed at L1 has been averaging 490-550 km/s through much of the period, but has recently declined to 450 km/s, which may indicate a weakening of the high speed stream. Solar wind density has also been steady around average through much of the last 24 hours but has also declined to below average values at the end of the period. Magnetic field strength has been weak throughout, with the north-south component, Bz, also varying weakly. Phi angle has been mainly negative (towards the Sun). Geomagnetic activity has been Quiet to Unsettled, with one Unsettled interval.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, has been at background levels. The high energy electron flux (greater than 2MeV), as measured at GOES16, reached 2420 pfu at 04/1715 UTC, but has been moderate since 04/2030 UTC. Electron fluence started just above the Active threshold, but has been following a declining trend, and passed through 8.15e7 integrated pfu at 05/0001 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is forecast to be mainly Low, with a slight chance of Moderate activity.

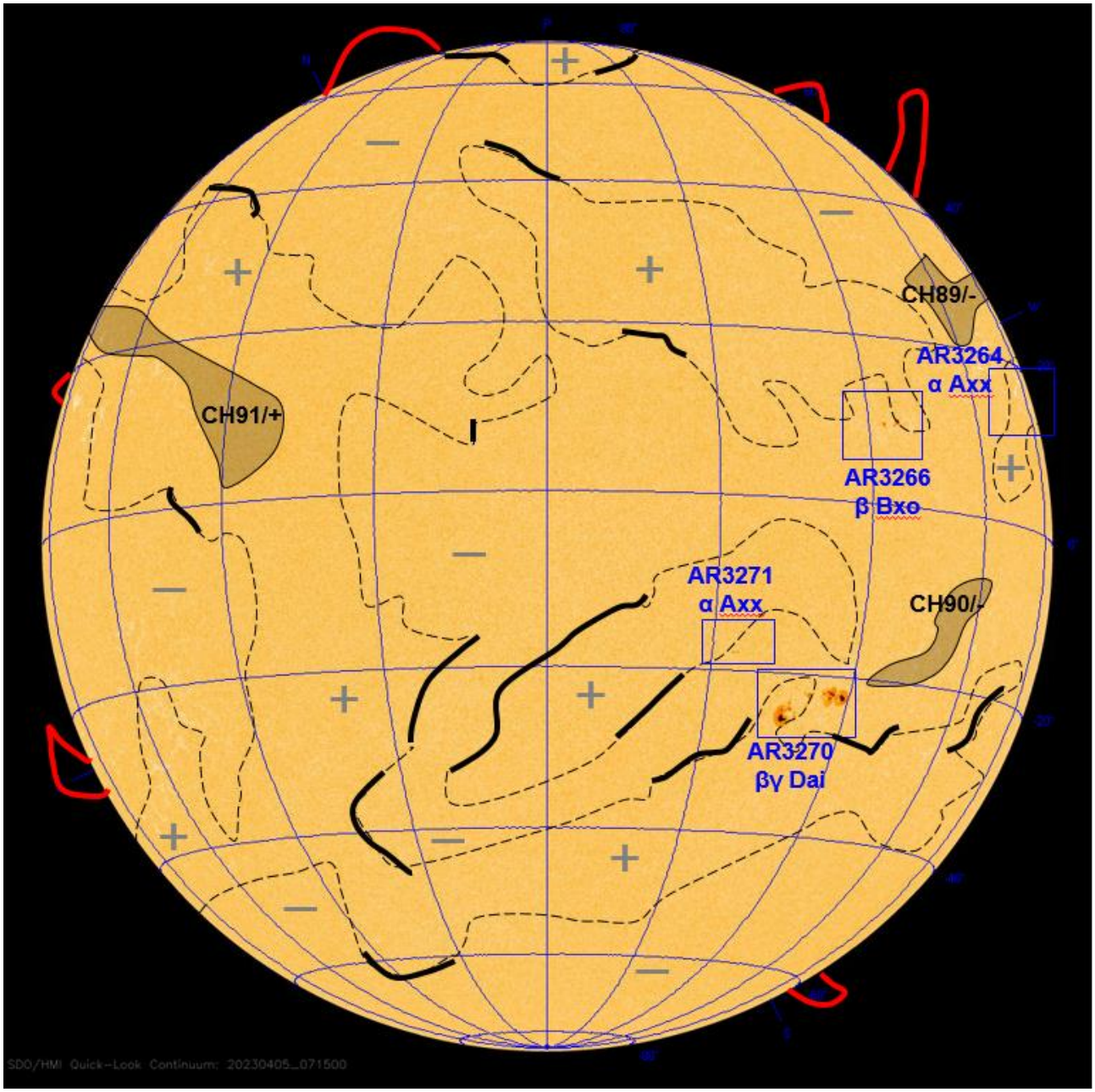
Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast to affect the Earth through the next four days. A current high speed stream of around 500-550 km/s, from a combination of coronal holes 89 and 90 is currently affecting the Earth, with a decline expected through the remainder of the period. Geomagnetic activity is forecast to be mainly Quiet to Unsettled, with a risk of Active to G1/Minor Storms on 05 Apr.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as observed by GOES-16 is at background levels and is likely to remain so, in the absence of significant flare activity. Electron flux values are expected to vary between moderate and high levels. Electron fluence is likely to be near or just below the Active (1e8 integrated pfu) threshold, perhaps increasing slightly later in the period.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 1. Solar Analysis Valid 05/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:
There are no Earth-directed CMEs expected.

A CME seen emanating from the southeast of the Sun early on 05 Apr, appears to have been the result of a prominence eruption from close to the southeast limb, and as such is unlikely to be Earth-directed. Further analysis will be undertaken as C2 and C3 imagery becomes available.

Two coronal hole high speed streams are currently affecting the solar winds, with speeds of 490-550km/s forecast to continue through much of 05 Apr. A decline is then expected through the remainder of the period with no further high speed streams expected to connect with the Earth. Geomagnetic activity is forecast to be mainly Quiet to Unsettled, with a slight chance of Active or G1/Minor Storms on 05 Apr.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	10	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Recent solar wind data at L1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

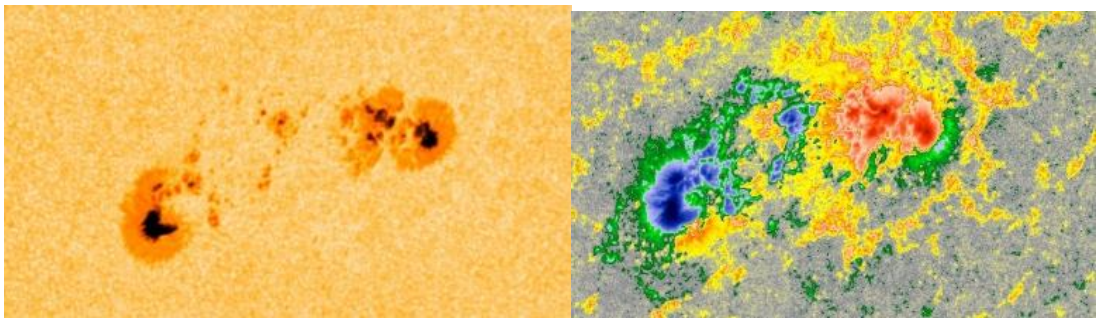
Radio Blackouts - X-Ray Flares:

There are four sunspots on the visible disc, with AR3270 the most prominent feature, carrying the highest risk. The region has developed a weak delta spot on two occasions, but each time has simplified and lost the delta spot. The remaining regions are all relatively simple.

Mainly Low activity is expected with a very slight chance of Moderate activity.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	10	10	10	10
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: AR3270 on SDO HMI intensiitygram and magnetogram imagery



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV), as observed by GOES-16, is forecast to remain at background levels, pending any significant sunspot development. There is an extremely slight chance of protons reaching the S1 level, most likely from AR3270 which is in a good position to connect with Earth should a larger flare occur in the forecast period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	3	3	3	3
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

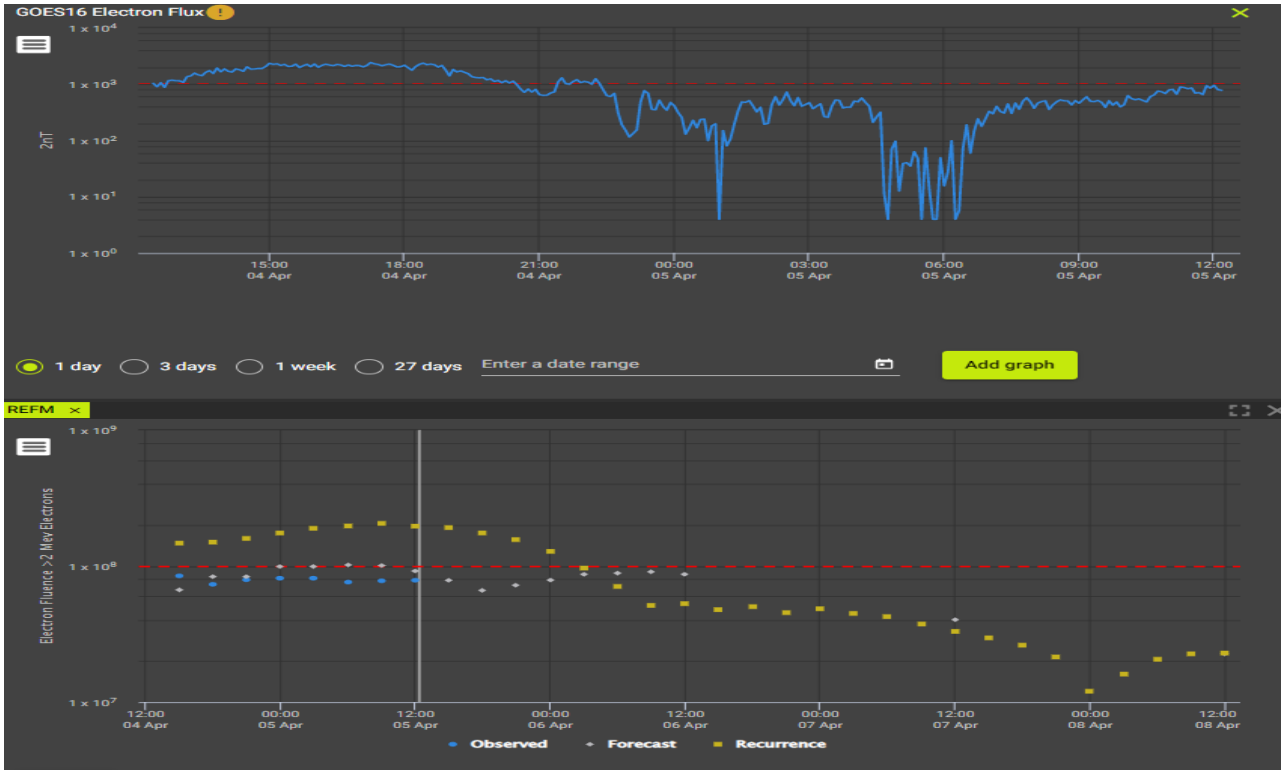
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) is forecast to oscillate between moderate and high (1000 pfu) through the forecast period on a diurnal cycle, as the solar wind speed eases, reducing the rate of electron inputs into the radiation belts. High levels are still likely on diurnal peaks, but with a decreasing magnitude. The British Antarctic Survey Radiation Belt Model (BAS-RBM) is forecasting a build of high energy electron density at lower orbits, which could relax towards GEO as the solar wind speed, and by inference, pressure eases.

Electron fluence has been following a downward trend due to the fall in peak electron counts. This fall is likely to be fitful, due to the variance of the electron flux levels, but an overall downward trend is likely. However due to the build of electron, there is a chance of a sharp rise as the solar wind speeds ease.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	Yes	60	50	50	50
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: GOES 16 electron flux (top) and electron fluence (bottom)



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.